Owner's Manual for the BESSTA Preamp Module

December 26, 2023

by Michael Bafaro

Purpose: The purpose of this manual is to guide the owner of the BESSTA replacement preamplifier for the Gibson model SST guitar through its installation in the original guitar. The BESSTA is designed to be an exact replacement for the original Gibson preamp. Since the circuit uses a TL072 FET input opamp, which can easily be damaged by static electricity, the person installing the module in the guitar **MUST FOLLOW PROPER ANTI-STATIC PROCEDURES.**

CAUTION: The original Gibson preamp uses the same TL072, and steps have been taken to keep the JFET opamp safe from static discharge by grounding the controls and their mounting bracket to the ground plane of the preamp. This was done with a ground wire soldered to one of the controls, and the other end inserted into a ground hole in the preamp circuit board near pin 4 of the TL072. This ground wire **MUST BE REMOVED** from the original board and inserted into the ground hole provided in the new board located near pin 4 of the TL072 (the 8 pin DIP pack).

Replacing the Old Board with the New BESSTA: If the relative humidity in your workshop is less than 45%, you must use a grounding strap from your wrist to the mounting bracket or the ground plane on the Printed Circuit board. First, unsolder each of the control contacts from the original board with a 23W soldering iron and a vacuum device to remove the solder around the control pins. Care must be taken to ensure that the solder and/or flux do not get into the insides of the three controls. After the controls are free of the board, then unsolder the ground wire that is connected to a ground hole in the old circuit board located next to pin 4 of the 8 pin DIP pack, which is the TL072. Disconnect the three cable assemblies for the pickup, the output jack, and the battery.

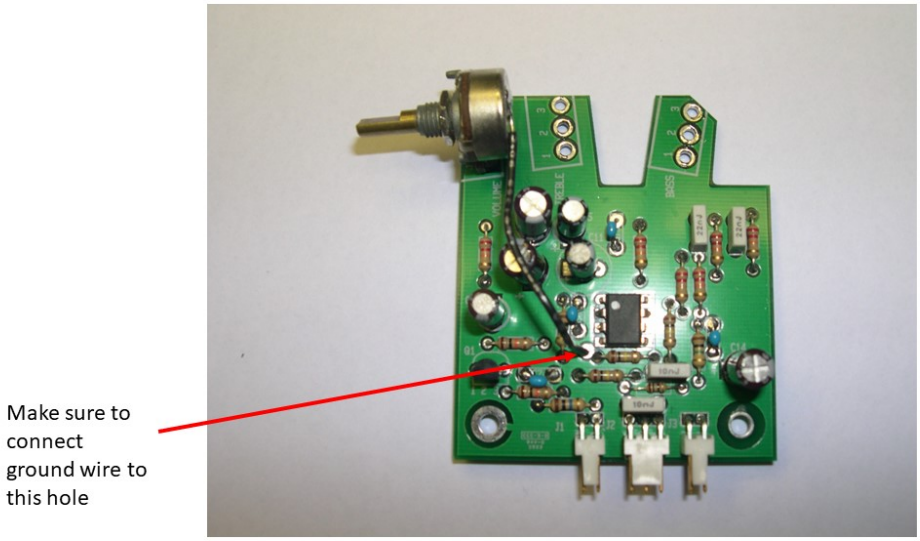

Figure 1

Install the new board by mounting it in the same way as the original board to ensure that the assembly will fit into the guitar without straining the contacts of the controls. Then connect the ground wire to the ground hole near pin 4 of the 8 pin DIP pack. See figure 1. Then solder each of the pins of the controls to the new circuit board. Care must be taken to ensure that no solder or flux gets into the controls during the soldering process. Reconnect the cable assemblies as discussed above. The guitar should be ready to test.

Noisy Controls: If the issue with the guitar is that the volume and/or tone controls are noisy when rotated, they can be cleaned with Deoxit F5 series spray cleaner from Caig Labs. If you wish, you can send the assembly to me, and I will clean the controls at no extra charge, except for the shipping.

Theory of Operation: The schematic of the preamp is shown in Figure 2.

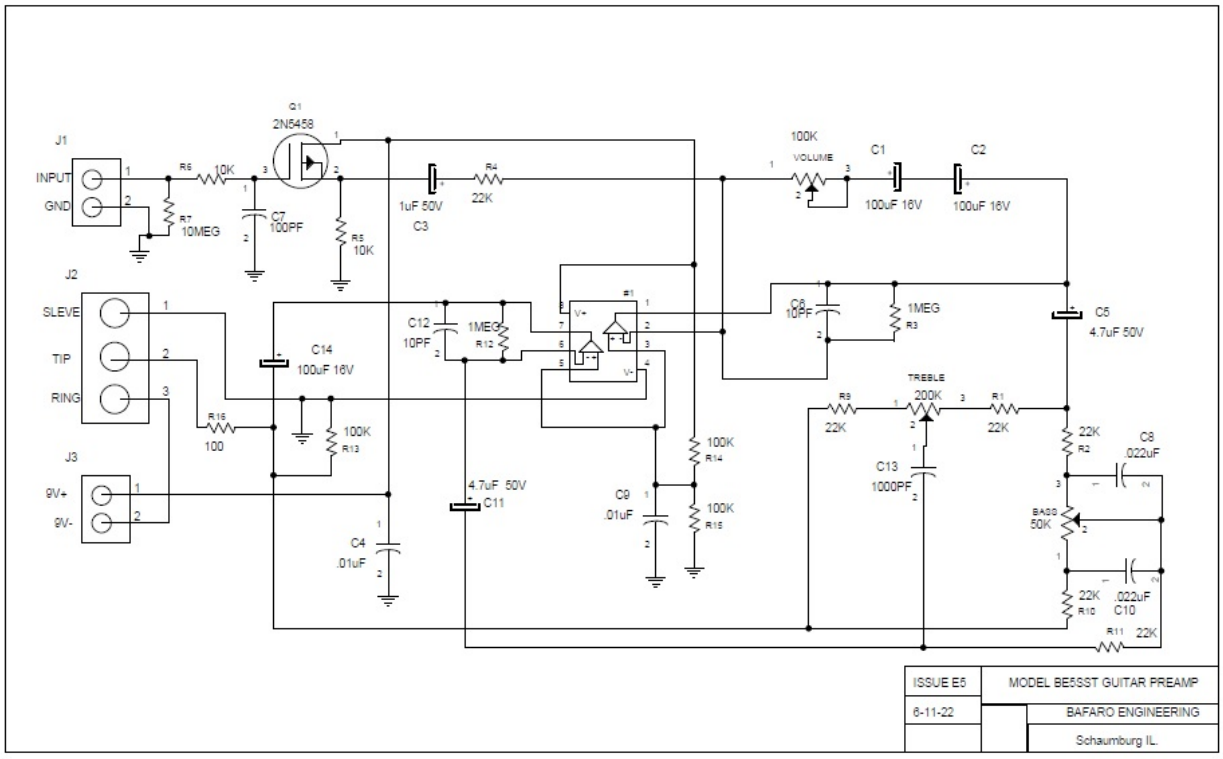

Figure 2.

The input from the guitar pickup is routed through J1 and terminated at 10 Meg Ohms before being coupled into the gate of the JFET Q1. The FET Q1 acts as a buffer, reducing the source impedance to approximately 10K Ohms, with a source voltage of about 1.85V. It is crucial that the source voltage is not 0V or at the full battery voltage.

The output of the FET buffer passes through C3 and R4 to the negative input (pin 2) of the TL072 dual opamp. The opamp's gain is determined by the resistance setting of the volume control divided by the value of R4 (22K). R3 ensures that the DC operating voltage of the opamp closely aligns with the bias voltage set by the R14 and R15 divider, along with the bypass cap C9. All active opamp pins (1, 2, 3, 5, 6, 7) should be very close to half of the battery voltage.

The output of the first opamp (pin 1) is connected to the volume control through (C1, C2), as well as the bass and treble tone circuit R1, R2. Concerning the treble control, the gain of the second opamp (pins 5, 6, 7) above approximately 1KHz is determined by the value of the pot from pins 1 to 2 added to R9, plus the capacitive reactance (Xc) of C13 divided by the value of the treble pot from pins 2 to 3, plus the reactance of C13. This forms a high-pass filter, providing about 9.5dB treble boost and cut at 20KHz.

The Xc of C8 and C10 with R11 forms a low-pass filter around the opamp, providing about 10dB bass boost and cut at 20Hz relative to 1KHz. The level of boost or cut depends on the bass

control setting. Both bass and treble feedback circuits are directed through DC blocking capacitors C11 and C14.

The output is coupled through R16 (100 Ohms) to pin 2 of J2. The 100 Ohm resistor ensures opamp stability when loaded with a substantial capacitive load, such as a length of coaxial cable. The DC power (negative) is fed to pin 3 of J2, which connects to ground when the phone plug is inserted. This way, the preamp only draws current from the battery when the phone plug is inserted.

Parts List:

Ref Des	Value	Description	Part Number
C1	100uF 16V	Radial lytic 100uF 16V	UPM1C101MED1TA
C2	100uF 16V	Radial lytic 100uF 16V	UPM1C101MED1TA
C3	1uF 50V	Radial lytic 1uf 50V	ELE-500ELL1R0ME11D
C4	.01uF 50V	Film cap .01uF 50V	MMK5103J50J01L4BULK
C5	4.7uF 50V	Radial lytic 4.7uF 50V	UVZ1H4R7MDD1TD
C6	10pF 50V	Disc ceramic cap 10pF 50V	RDE5C1H100J0M1H03A
C7	100pF 100V	Disc ceramic cap 100pF 100V	RDE5C1H101J0K1H03B
C8	.022uF 50V	Film cap .022uF 50V	MMK5223J50J01L16.5TR
C9	.01uF 50V	Film cap .01uF 50V	MMK5103J50J01L4BULK
C10	.022uF 50V	Film cap .022uF 50V	MMK5223J50J01L16.5TR
C11	4.7uF 50V	Radial lytic 4.7uF 50V	UVZ1H4R7MDD1TD
C12	10pF 50V	Disc ceramic cap 10pF 50V	RDE5C1H100J0M1H03A
C13	1000pF 50V	Film cap .001uF 50V	MMK5102M50J01L4BULK
C14	100uF 16V	Radial lytic 100uF 16V	UPM1C101MED1TA
Q1	2N5458	Transistor TO92 2N5458	2N5458
U1	TL072A	FET input dual op amp TI	TL072IP
R1	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R2	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R3	1Meg 1/4W	Resistor film axial 1Meg 1/4W	CF1/4JT1M00CT
R4	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R5	10K 1/4W	Resistor film axial 10K 1/4W	CF1/4C223J
R6	10K 1/4W	Resistor film axial 10K 1/4W	CF1/4C223J

R7	10Meg 1/4W	Resistor film axial 10Meg 1/4W	CF14JT10M0
R8	not used		
R9	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R10	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R11	22K 1/4W	Resistor film axial 22K 1/4W	CF1/4C223J
R12	1Meg 1/4W	Resistor film axial 1Meg 1/4W	CF14JT1M00
R13	100K 1/4W	Resistor film axial 100K 1/4W	CF1/4C104J
R14	100K 1/4W	Resistor film axial 100K 1/4W	CF1/4C104J
R15	100K 1/4W	Resistor film axial 100K 1/4W	CF1/4C104J
R16	100 Ohms 1/4W	Resistor film axial 100 Ohms 1/4W	CFR-25JT-52-100R

Figure 3 parts list.

I hope this helps! If you have any further questions or need additional clarifications, feel free to ask. If you have any questions, you can email me at m.bafaro@comcast.net.